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STOCK INDEX FUTURES
THE CASE FOR MARKETS IN BASKETS OF SECURITIES

Ian Cooper
London Business School
and
Antonio S. Mello
Massachusetts Institute of Technology

Working Paper No. 3051-89-EFA

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ABSTRACT

We provide an explanation for the explosive growth in the popularity of Stock Index Futures contracts. In our economy there are three broad classes of traders that place orders with a competitive market maker that sets a bid-ask spread arising from adverse selection. Informed traders trade on the basis of their private information about the value of particular securities. Liquidity traders trade either specific stocks, or wish to trade diversified portfolios. We show that the Stock Index is the efficient trading vehicle for this last class of traders, who abandon the spot securities markets with consequences for the liquidity of individual stocks. The reason is that the costs faced by diversified traders will be lower in the Index market than in markets for individual stocks, because any idiosyncratic information flowing in the Index market is substantially lower than that brought by insiders to the spot market. Stock Index Futures contracts are, therefore, convenient innovations for financial institutions that trade large portfolios of securities to match the liquidity needs of their clients. We predict that the innovation of index contracts adversely affects the liquidity of individual stocks. Trading in the stock market becomes more costly for those traders whose strategies involve the purchase or sale of specific securities.

STOCK INDEX FUTURES
THE CASE FOR MARKETS IN BASKETS OF SECURITIES

Ian Cooper* and Antonio S. Mello**

I. INTRODUCTION

The popularity of Stock Index Futures results from a combination of low transaction costs, the ability to execute short positions and the implicit leverage of the futures contract. Transaction costs can be reduced relative to spot trades in two different ways. One, common to all futures contracts, is related to the organization of these markets as exchange-traded contracts. By concentrating volume in a few standardized contracts and by centralizing the clearing procedures, the futures exchanges achieve important economies relative to spot transactions in the underlying asset. The other is specific to Index contracts, which allows efficient transactions of a well diversified basket of securities.

In this paper we examine how the Index futures contract can help liquidity traders to reduce their costs of transacting. We concentrate on the cost savings that arise from the fact that the contract is written on an index, rather than the gains common to all futures contracts. Transaction costs take the form of a bid-ask spread that enables a competitive market maker to survive in the presence of investors with superior information (see Glosten and Milgrom [5]).

* London Business School

** Massachusetts Institute of Technology

The privately owned information of some traders is material to the pricing of individual stocks. In deciding where to capitalize on this knowledge, these traders compare the profits expected under different alternatives. The proportion of specific stocks in the value of the index is known to everyone in the market. Thus, information on a security included in the index can either be traded directly in the spot market for the security or via the index. We show that, in equilibrium, the spot market is typically the convenient trading medium for informed traders. As a result, the flow of private information passing through the spot market is greater than that going through the Index futures market. The difference is reflected in the spreads for transacting equivalent baskets of securities. The single transaction achieved by the Index results in lower transaction costs than trading in markets for individual securities. The Index contract is then an efficient trading mechanism for diversified liquidity traders.

We also investigate the impact of innovating a market for the index on the spreads of individual stocks and on trading costs of specialized investors. We show how the new index contract redistributes wealth among the various groups of traders. The greater is the number of investors willing to execute their transactions via the Index, the lower is liquidity of individual stocks. That is, spreads in the stock market will widen after the migration of volume to the Index market. Two results then follow: trading by uninformed investors on specific stocks will diminish and less informative becomes the stock market.

The paper is organized as follows: In Section II, we develop the microstructure model used in this paper and examine the determinants of the bid-ask spread in the markets for individual securities. Next, we introduce an index contract and analyze the trading strategies followed by different traders given the costs of the various alternatives. We then consider and discuss the conditions necessary for an equilibrium to exist. An equilibrium satisfies the conditions that all markets in the economy remain open and operating and that, for each market, the dealer is able to find a feasible solution to his problem. Finally, in Section IV we assess the impact of the development of the Index contract on the costs of transacting of the different groups of traders.

II. DETERMINATION OF THE BID-ASK SPREAD

The market we model is a pure dealership model. Traders do not transact directly with each other, but through a risk neutral, competitive dealer. Traders arrive singly and randomly at the market. Upon arrival, traders become informed of the prices at which the dealer is willing to buy and sell a fixed quantity of the asset. They then decide whether or not they want to place an order. Although the dealer must stand behind his quotes, he is not prevented from revising them between trades.

Traders are characterized by possessing information of different quality and by their relative preferences for the various stocks. Some traders are assumed to be informed about the value stocks will take at t+1. Informed traders can only discover the true value of one stock at a time, and know nothing about all other stocks in the economy. Alternatively, all

private information available is idiosyncratic and any systematic component of the security price innovation is known to everybody. The reason we consider only the case of stock specific information as the type of information possessed by insiders is because systematic information is usually inferred from public information (i.e., macroeconomic data).

All traders are risk neutral. Those who do not trade on the basis of their private information (liquidity traders), do it for a variety of reasons typically determined outside the financial market. Their transactions are characterized by their relative preferences for the various stocks. Some consider all securities as substitutes for each other and tend to maintain and transact diversified portfolios. Others find that some securities are preferred to others and make more specialized transactions. However, it is assumed that liquidity traders expected demand for trade is spread sensitive.

Consider a security traded over a single period. Trade takes place at time t and at time t+1 the security is liquidated. At this time prices reveal the value of any piece of information brought to the market at t [1].At time t the value of the stock is denoted by S_o which is assumed to be public knowledge. The liquidation value at time t+1, is any realization of the uniformly distributed random variable $\tilde{S}$ in the interval of values $[\underline{S},\overline{S}]$, s.t. $\overline{S}-\underline{S} = 2\lambda$

In the absence of adverse selection S_o represents the price at which the stock should be traded. However, knowing that there is a positive probability that the next trade may be motivated by superior information,

-

the market maker quotes a bid and an ask price, (P_b,P_a), at which he is prepared to buy and sell a standard quantity of the stock.

Any investor arriving at the market decides to trade if his personal valuation of the stock is either lower than P_b or higher than P_a. In particular, informed traders who choose to trade will have a sure gain. Denoting by p the proportion of informed traders in the market for the stock, the dealer's expected loss to them is:

$$L(p,q,s) = pqE[(\tilde{S}-P_a)J_{\{S_o+s<\tilde{S}\leq\bar{S}\}} + (P_b-\tilde{S})J_{\{\underline{S}\leq\tilde{S}<S_o-s\}}] \tag{1}$$

where $J_{\{S_o+S<\tilde{S}\leq\bar{S}\}}$ and $J_{\{\underline{S}\leq\tilde{S}<S_o-s\}}$ are respectively, the indicator functions of the purchase and sale events, with $J\{\bullet\}$ equal to one if that event occurs and zero otherwise. q denotes the size of the transaction.

For simplicity take q=1 as the standard quantity [2]. Then, expression (1) may be written as:

$$L(p,1,s) = p[\int_{Pa}^{\bar{S}} (\tilde{S}-P_a)f(S)dS + \int_{\underline{S}}^{P_b} (P_b-\tilde{S})f(S)dS] \tag{2}$$

Solving (2) and recalling that $f(S) = (2\lambda)^{-1}$, we have:

$$L(p,1,s) = p[1/2(\bar{S}-Pa)^2+1/2(P_b-\underline{S})^2]/2\lambda \tag{3}$$

and substituting P_a and P_b by S_o+s and S_o-s respectively, gives, after simplification, [3]:

$$L(p,1,s) = p(\lambda-s)^2/2\lambda \tag{4}$$

to stay in business the dealer must expect to recover his losses from trading with informed traders. He can do so by processing orders originated by liquidity traders (see Bagehot [2]). Denote by $d(s,p)$ the probability that a liquidity trader will place an order after learning that the spread has value s. We then assume that $d(o,\lambda) = 1$ and $d(\lambda + \xi, \lambda) = 0$, for $\xi>0$. That is: if the spread has a zero value, the next liquidity trader is expected to always place an order; if the spread is big enough for the dealer's quotes to lie outside the interval $[\underline{S},\overline{S}]$, the next liquidity trader is expected not to enter the market. We further assume linearity between this probability measure and the observed value of the spread [4]. Then, the dealer's expected gain from an uninformed transaction is:

$$G(p,1,s) = sd(s,\lambda) = s(1-p)(1-s/\lambda) \tag{5}$$

competition is assumed to force the expected profits of the market maker to zero. For the standard quantity traded, s is the solution to the equality $L(p,1,s) = G(p,1,s)$:

$$p(\lambda-s)^2/2\lambda = s(1-p)(1-s/\lambda) \tag{6}$$

using $c = (1-p)/p$, we get a quadratic equation in s. Since $(1+c)^2>2(c+1/2)$, there is always solution in the positive part of the real line. In fact, there are two positive roots of the equation:

$$s = \lambda \text{ and } s = \lambda/(2c+1) \tag{7}$$

Both give zero expected profits for the market maker, but only $\lambda/(2c+1)$ satisfies the competitive market assumption, since for any $s \in]\lambda/(2c+1),\lambda[$,

the expected profits of the market maker are positive, $E(\tilde{\pi}|s)>0$. From identity (7) we can see that:

$$\partial s/\partial p = 2s(2c+1)/p^2 \geq 0$$

$$\partial s/\partial \lambda = 1/(2c+1) \quad \geq 0$$

The higher the probability that the next transactor is informed, the bigger the spread at which the dealer is willing to trade. The larger the potential value of superior information, expressed by the dispersion parameter λ, the bigger the dealer's expected losses to informed traders and so the larger the spread must be. The elasticity of demand by liquidity traders also affects the value of the spread. In the case of inelastic demand by these traders the value of the spread becomes $\lambda[(1+c)-c(c+2)^{1/2}]$, which can be shown to be lower than the value obtained for the elastic case. In the limit case of infinite elasticity, no liquidity traders would be willing to trade at $s>0$, and the market for the security would break down, since no market maker would trade in the absence of uninformed trading.

III. ECONOMY WITH MANY SECURITIES AND A BASKET

After examining the determinants of the size of the spread, we now turn to the question of how investors decide between the different alternative strategies to carry out their transactions. There are N markets for individual securities, with i=1.... N, and a contract to trade a basket of these securities. This contract is exchanged now for settlement some time in the future, at time t+dt. For simplicity the basket is equally weighted

with unit weights. Assume that there is no money transferred until the maturity of the futures contract, and that the risk free return in the economy for the period dt equals R. Also, consider that the securities have zero yield during dt. Given the design of the basket and the particular preference of the participants, the rational dealer sets the parity value for the futures contract at $F = R\sum_{k}^{N} S_{ok}$

Since each stock is traded either as a component of the basket or directly in the spot market, informed traders consider both alternatives. Suppose, for example, an investor anticipating that security i will go up in value to S_i. The following proposition offers a formal statement about his trading behavior:

Proposition 1: An informed trader never takes simultaneous and opposite positions in the Index futures contract and the spot securities markets.

Proof: The informed trader observing S_i expects to gain $S_i - P_{ai}$ from placing an order in the spot market for security. Alternatively, he may pay $P_{af}R^{-1}$ to trade the Index and expects from this "unhedged" futures trade a profit of $E[\tilde{S}_f | S_i] - P_{af}R^{-1}$. Finally, he may realize his gains with the futures transactions and sell all other securities included in the basket but security i. In this last case his expected profits are $E[\tilde{S}_f | S_i] - P_{af}R^{-1} + \sum_{k \neq i} P_{bk}$. We now show that such strategy is never optimal. Comparing the first two alternatives implies that the spot trade will dominate the unhedged futures transactions if:

$$P_{ai} < P_{af}R^{-1} - \sum_{K\neq i} S_{ok} \quad (8)$$

which implies:

$$S_{oi}+s_i<(F+S_f)R^{-1}-\sum_{K\neq i} S_{ok} \quad (9)$$

denoting $s_f = S_f R^{-1}$, after simplifying gives $s_i<s_f$. A similar comparison between the first and last strategies implies that the spot trade will dominate the "hedged" futures trade if $s_i< s_f +\sum_{k\neq i} s_k$. Clearly, the third alternative, buying the basket and selling off all securities but i, cannot possibly dominate any of the other two•

Entering simultaneous and opposite positions in the spot and the futures for the Index is unjustified either on the grounds of risk preferences or rational profit maximization. Proposition 1 shows that in order to maximize expected gains, risk neutral informed traders only choose those strategies which do not require them to trade in securities for which they do not know anything special. But it fails to show which market provides the convenient trading medium for information based transactions. Proposition 2 states that typically these are the markets for individual securities.

Proposition 2: When all markets remain open in equilibrium, traders with information on a particular security may strictly prefer the spot market, but can never strictly prefer the Index futures contract. However, not all informed traders can prefer the spot market; at least those facing the highest spreads in the security about which they have information must be indifferent to trading the basket.

Proof: From Proposition 1, informed traders make their trading strategies by comparing s_i with s_f, for all i. From the same proposition it follows that when $s_i > s_f$ no information based trading of any kind must be expected in the market for security i. Expecting no losses, the market-maker will adjust s_i downward, until s_i becomes less than or equal to s_f. Consequently, for every security, $s_i \leq s_f$. If however, $s_i < s_f$ for every security i no informed trader will be expected to trade the basket. In that case a value of $s_f > 0$ will imply positive expected profits to the dealer $E(\tilde{\pi}_f | s_f) > 0$. Competition will force s_f downward. Eventually $s_f = s_k$ where $s_k = \mathrm{Sup}\{s_i : E(\tilde{\pi}_i | s_i) = 0\}$. If this particular value for s_f guarantees the dealer that $E(\tilde{\pi}_f | s_f) = 0$ then the pair (s_k, s_f) does not give traders informed on security k a clear preference between trading their knowledge in the market for k and in the futures market for the index. Therefore at least those insiders paying the highest dollar spreads in the spot market must be indifferent between trading the security directly and trading the index•

The immediate implication of Proposition 2 is: the discounted monetary value of the of the spread for the index is equivalent to the highest of the spreads for the N securities traded in the spot market, $s_i \leq s_k = s_f$, with i=1,.... N. Note, however, that the Index contract is N times the size of the average security trade, so the proportional spread in the index futures contract is significantly lower than that for the typical stock. Furthermore, if traders informed on different securities are simultaneously willing to trade the basket, it must be that the costs of trading those securities in the spot market are equal.

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One interesting thing about Proposition 2 is that it allows us to determine a clear relationship between the values of the spreads in different markets. What it fails to show, though, is whether there is an equilibrium with all markets open when informed traders follow their optimal strategies. For that we need to know how liquidity traders behave, since it is their actions that ultimately determine whether a particular market stays open or breaks down. To analyze this issue we make one further assumption.

Assumption: There are multiple classes of liquidity traders, L. Some traders just wish to trade one specific security, L_i. Other traders trade portfolios of different securities. Of these, some wish to trade a portfolio that includes all the securities that compost the Index, L_I.

The following proposition states that specialized liquidity transactions are typically completed in the spot markets for individual securities.

Proposition 3: Liquidity traders wishing to trade one specific security always prefer to use the market for that security and never trade the Index.

Proof: To accomplish their purpose these traders either trade the security, at a cost of s_i, or the index. Since the last alternative differs from the intended one in that it involves stocks other than i, further adjustment is required. As a result its spread costs total $s_f + \sum_{J \neq i} s_j$. If for security i, $s_i < s_f$, then the spot trade is preferred. Suppose that $s_i = s_f$. Then $\exists_j, s_j > o$ trading security i directly will again dominate trading in the index market•

In fact, trading the basket for the purpose of buying and selling a specific security is typically an inefficient strategy for both informed and liquidity traders. If specialized liquidity trades occur in the spot market, we should however expect that orders to transact portfolios replicated by the traded Index can be better achieved in this market. The following proposition shows that that is indeed the case:

Proposition 4: Liquidity traders trading a portfolio that matches the Index always prefer to use the Index market.

Proof: Trading each of the N securities included in the basket costs $\sum^{N} s_i$. With the Index contract the equivalent operation costs s_f. From Proposition 2 for at least one $k, s_f = s_k$, with other $s_i \geq 0$. Consequently, trading the Index will always dominate the alternative spot transaction•

Note how convenient the contract on the Index is for perfectly diversified liquidity traders. The costs of trading all securities in the form of a package are never more than those trading all securities separately. The substantial savings achieved demonstrate that markets in baskets of securities provide the most efficient trading medium for such investors. As for investors trading portfolios not exactly equal to the traded Index, which market is better depends on the composition of the specific portfolio, as those traders must execute further adjustments in the individual securities markets.

We are now in a position to define an equilibrium in an economy with many securities and a futures market for an aggregate stock index.

Definition: An equilibrium is a set of N+1 real valued functions $s(p,\lambda,d(s))$, such that:

i. $E\left[\tilde{\pi}_i \middle| s_i^e, 0 \le s_i \le \lambda_i\right] \ge 0 \qquad ,\forall i$

For every security in which the dealer is willing to make a market, the bid -ask spread guarantees him at least zero expected profits from trading.

ii. $s_i^e(\bullet) = \inf\{s_i : E(\tilde{\pi}_i | s_i)\} \ge 0 \qquad ,\forall i$

The value of the spread in each market gives no incentive for a profit maximizing, risk neutral dealer to attempt a different pricing strategy, nor for a new dealer to establish himself.

iii. $s_i^e(\bullet) \le s_f^e(\bullet) \le \sum_j^N s_j^e(\bullet) \qquad ,\forall i$

The dollar value of the spread for the Index contract is neither smaller than any of the spreads for the individual securities, nor larger than the sum of these same spreads.

iv. $\exists_k$ s.t. $s_k^e(\bullet) = s_f^e(\bullet)$

There is at least one security with the same dollar bid-ask spread as the index spread.

When the above conditions are satisfied there exists an equilibrium that is unique in the economy with N securities markets and a contract for the Index asset. To see why this is the case, suppose that we start with no information trades in the Index market. Competition, at that point would set $s_f = 0$ and $s_i = \lambda_i/(2c_i+1)$ for all securities i. Suppose that security k has the highest spread, followed by security j, etc., so that $s_k > s_j > \ldots > s_f$.

Informed traders paying to transact their knowledge will start to migrate to the Index. Then s_f rises and all spreads in the securities market fall. If a point is reached where $s_f = s_k$ before s_k falls to be equal to s_j, then an equilibrium is attained with $s_f = s_k > s_i$, $\forall i \neq k$. If not, then information on security j will be brought to the Index market, as well as information on security k. This continues until in equilibrium $s_f = s_k = s_j > s_i$, $\forall i \neq k,j$. If this still is not an equilibrium because at that point $\exists m$, such that $s_m > s_f$ formation on m will also be brought to the Index market, etc.

The index attracts liquidity traders who wish to transact diversified portfolios. These traders are then followed by some information traders. In equilibrium the dollar cost of trading the Index must be such that no informed trader has incentive to alter his trading strategy. Some will find the spot securities markets best, a few will be indifferent finding both the Index and the spot market equally attractive. The result gives a unique equilibrium relationship for the values of the different spreads in the various markets. From the uniqueness of the equilibrium results the following proposition:

Proposition 5: The probability of an uninformed trade in the Index market equals a weighted average of the probabilities of liquidity traders in the markets for the securities that, in equilibrium, satisfy $s_k = s_f$.

Proof: Suppose n indifferent informed traders indifferent to trading the Index or the individual securities about which they have their idiosyncratic

information. Define p_{kf} to be the probability on an informed trade in the Index market carrying information about security k. Then s_f must be the lowest positive root of the quadratic equation:

$$\sum_k^N p_{kf}(\lambda_k - s_f)^2/2\lambda_k = s_f d(s_f, \lambda_f) \tag{10}$$

Where $\lambda_f = \sum^N \lambda_k$. Recall the corresponding expression for each of the k stocks:

$$(\lambda_k - s_k)^2/2\lambda_k = s_k d(s_k, \lambda_k)/p_k$$

From Proposition 2 in equilibrium $s_k = s_f$, for all k. Then we re-write (10) as:

$$\sum_k^N p_{kf} s_k d(s_k, \lambda_k)/p_k = s_f d(s_f, \lambda_f) \tag{11}$$

$$s_k \sum_k^N p_{kf} d(s_k, \lambda_k)/p_k = s_f d(s_f, \lambda_f) \tag{12}$$

which simplifies to:

$$\sum_k^N p_{kf} d(s_k, \lambda_k) = p_k q(s_f, \lambda_f) \tag{13}$$

Therefore, when information on different securities may be simultaneously traded in the market for the Index, the probability of an uninformed trade in the index is equal to a weighted average of the probabilities of liquidity trades in each of the securities that, in equilibrium, satisfy the condition that $s_k = s_f$. Each weight is the ratio of the probabilities of informed trades for security k being placed via the index to its probability of the order being placed in the spot market. Note that if only one security satisfies the condition that $s_k = s_f$, expression (13) reduces to $d(s_k, \lambda_k)/p_k = d(s_f, \lambda_f)/p_{kf}$.

Proposition 5 states that an equilibrium requires that for those markets satisfying the condition that $s_k = s_f$, the spreads adjust such that the ratio of expected uninformed to informed trades is equal.

IV. INNOVATION OF THE INDEX CONTRACT: IMPACT ON MARKET SPREADS AND ON TRADING COSTS

In the previous section we analyzed the conditions that make possible the co-existence of markets for many securities and a market for a basket of such securities. We also concluded that liquidity traders with diversified portfolios use the market for the basket as their optimal trading vehicle. We now examine the impact of innovating the Index contract on the spreads of the other existing markets, as well as on trading costs faced by the different classes of traders. The next two propositions state the effects experienced in the markets for individual securities:

Proposition 6: If, after the Index has been innovated, $s_i<s_f$, s_i is higher as a result of introducing the index contract.

Proof: s_i is monotonically decreasing in c_i. If the Index market stays open it must be that $s_f \leq \lambda_f$. This implies that there are liquidity traders that wish to trade diversified portfolios. Before the innovation of the Index contract, their trades were executed in the markets for the securities. Consequently, there is a reduction in the volume of liquidity trade in those markets. Also, since $s_i<s_f$ a spot transaction must still be preferred by traders informed on stock i. That is, the innovation displaces liquidity

trade but not information based trade. Consequently c_i drops after the introduction of the market for the index, and s_i increases•

Proposition 7: The innovation of the Index contract increases the value of the spread in the market for the security that, in equilibrium, satisfies the condition that $s_k = s_f$.

Proof: Define ε_k and ε_I as the elasticities of liquidity traders wishing to trade security k and the Index, respectively. L_k and L_I, M_{kk} and M_{kI} are the total expected number of liquidity trades trading security k, liquidity trades in the Index, total expected number of informed traders on security k that choose to be in the market for k and in the market for the Index, respectively. Recall that the ratio of probabilities of liquidity to informed traders in each market, c, equals the ratio of the numbers in each class, L/M. Then we write expression (13) as:

$$L_k(1-s_k/\lambda_k)/M_{kk} = L_I(1-s_f/\lambda_f)/M_{kI} \tag{14}$$

Before the Index is made available for trading the correspondent ratio for security k is:

$$(L_k+L_I)(1-s'_k/\lambda_k)/(M_{kk}+M_{kI}) \tag{15}$$

Where s'_k is the equilibrium spread in the market for security k in an economy with no index. $s'_k = s_k$ implies that (14) equals (15):

$$L_k(1-s_k/\lambda_k)/M_{kk} = (L_k+L_I)(1-s'_k/\lambda_k)/(M_{kk}+M_{kI}) \tag{16}$$

$$(L_k/M_{kk})(1-s_k/\lambda_k) = [(L_k/M_{kk})\varphi_k+(L_I/M_{kI})(1-\varphi_k)](1-s'_k/\lambda_k) \quad (17)$$

where $\varphi_k = M_{kk}/M_k$, is the proportion of informed traders that are expected to stay in the market for k after the index is innovated. Re-writing (17) yields:

$$(L_k/M_{kk})/[(L_k/M_{kk})\varphi_k+(L_I/M_{kI})(1-\varphi_k)] = 1 \quad (18)$$

$$(L_k/M_{kk})(1-\varphi_k) = (L_I/M_{kI})(1-\varphi_k)$$

$$L_k/M_{kk} = L_I/M_{kI}$$

$$c_k = c_I \quad (19)$$

That is, there will be no effect on the spread if the ratio of liquidity to information trades in both the market for security k and the index market are equal. However, it can be shown that $\varepsilon_k = 1/2\ c_k$ and $\varepsilon_I = 1/2c_I = \lambda_k[\lambda_f R^{-1}(2c_k+1)-\lambda_k]$, with $\varepsilon_k>\varepsilon_I$ for any positive value of c_k. Consequently $c_k<c_I$, implying that $s'_k<s_k$.

From the two last propositions, one can conclude that the innovation of a market for a basket of securities will produce an adverse effect on the costs of transacting of all classes of traders that execute their orders in the stock market. Being spread sensitive the volume of liquidity trading will be reduced. Similarly with higher spreads, investors trading on idiosyncratic information expect to make lower profits. This reduces the

economic incentives for trading on information that implies only a small change in the value of the security. As a result, it may be that the total amount of resources devoted to information gathering diminishes, and prices are apt to be less informative. In fact, the introduction of the new market may act as a mechanism that scales down any over-investment in discovery, since it reduces the excess of the private benefit over the social one.

Specialized traders, both informed and uninformed, bear the effects resulting from a redistribution of trading expenses among the different classes of investors in the economy. In that case only diversified traders wishing to execute their orders in the market for the Index gain. Their costs go from $\Sigma s_k'$ before to s_f after. The lower transaction costs reflect the amount of information being traded in the market for the basket of securities relative to the amount that flows in the markets for individual securities. The larger the number of components of the basket the larger the difference in flow of information between the two trading alternatives, and the greater the savings achieved by diversified traders. Since this class of traders is typically index fund or mutual fund portfolio managers satisfying the liquidity needs of investors, it is easy to understand the explosive growth in the popularity of stock index futures markets, as well as indexation strategies, over the past few years.

V. CONCLUSIONS

In this paper we explain why stock index futures provide a different trading mechanism for liquidity traders that wish to transact large portfolios of stocks. Those investors can minimize their transaction costs

by implementing index trading strategies instead of transacting in the markets for individual securities, where the adverse trades with informed investors are usually high. Thus the innovation of an Index contract induces separation, with diversified liquidity traders migrating to the new index market, and more specialized traders (liquidity and informed) staying in the stock market. As the spreads for specific stocks widen, trading volume in the stock market diminishes. Furthermore, prices of individual stocks become less informative, since it is more expensive to pass new information into the market.

NOTES

1. The simple information structure present in the model has the following justification. By determining that the time of revelation occurs in the period after orders have been placed, we ignore the more realistic succession of trades and price changes occurring while traders use their different information sets and the market searches for an agreement on the value of the asset. We do so because we are not so much concerned with examining the dynamics of the spreads, given the trading strategies of the various participants in a single market, rather in the behavior of traders when deciding in which market to carry out their transactions when alternative markets co-exist. In any case the model can be extended to include many periods if all trades and information on security values are serially uncorrelated.

2. For an extension to the multiple order size case see Mello [7]. Kyle [6] allows orders of finite size to a market maker by traders not knowing the market clearing price at the time orders are placed.

3. The dealer's quotes are symmetric around S_o, reflecting the market maker's expectation of a reasonably balanced trade around the value with no adverse selection.

4. The results seem to be robust for any other form of the probability function that is spread sensitive.

5. The model used here for setting the bid-ask spread is similar to that in Copeland and Galai [3].

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